

AMENDMENTS TO THE CLAIMS:

This listing of claims replaces all prior versions and listings of claims in the application:

LISTING OF THE CLAIMS:

1. (Currently Amended) A data transmission apparatus for use in a multiple service ring comprising at least two nodes ~~electrically connected~~ transmissively coupled to at least one aggregate pipe and to at least one tributary, said data transmission apparatus comprising:

a tributary receiving (RX) framer ~~electrically connected~~ transmissively coupled to a tributary, the tributary RX framer for deframing data frames received from said tributary and for extracting destination node addresses from received data frames;

a transmitting (TX) framer for encapsulating destination node addresses and data received from the tributary into data frames for the multiple service ring and for transmitting the data frames for the multiple service ring along an aggregate pipe to a downstream neighbor node in the multiple service ring;

a RX framer for receiving, and for deframing, data frames from the multiple service ring from a an upstream neighbor node along an aggregate pipe of the multiple service ring to obtain at least a destination node addresses and data;

a filter for determining data frames for a local node based on at least one obtained the destination node address, and for forwarding other data frames that are not for the local node to said TX framer to forward to another node of the multiple service ring;

a tributary TX framer for encapsulating data frames for the local node into tributary data frames and for sending the tributary data frames to a corresponding tributary;

wherein at least one aggregate pipe in the multiple service ring has an N-ring structure comprised of N-M unidirectional ringlets and M unidirectional counter-rotating ringlets, where N and M are integers and $1 \leq M < N$; and

a ring management unit for controlling use of ringlets in the at least one aggregate pipe, wherein controlling use of ringlets comprises assigning an (n-1)-th ringlet to transport data packets in a unidirectional direction and an n-th ringlet to transport control packets in a direction opposite to the unidirectional direction, where $1 < n \leq N$.

2 and 3. (Canceled)

4. (Previously Presented) The data transmission apparatus according to claim 1, wherein said n-th ringlet comprises a protection channel for the (n-1)th ringlet in case of failure of, or signal degradation of, the (n-1)th ringlet.

5. (Previously Presented) The data transmission apparatus according to claim 1, further comprising means for setting-up an identifier for use in identifying an originating tributary, wherein the identifier is encapsulated with a destination node address and data received from the tributary in at least one data frame for the multiple service ring.

6. (Previously Presented) The data transmission apparatus according to claim 5, further comprising means for determining a tributary type and a tributary number from at least one of the data frames for a local node for use in sending tributary data frames to a corresponding tributary.

7. (Previously Presented) The data transmission apparatus according to claim 6, wherein data frames of the multiple service ring comprise ~~are~~ FE/GE/10GE MAC frames.

8. (Currently Amended) The data transmission apparatus according to claim 7, further comprising a CWDM/DWDM (Coarse Wavelength Division Multiplex/ Dense Wavelength Division Multiplex) unit for transmitting multiple aggregates, wherein:

for CWDM, an aggregate FE, GE and 10GE frames, where $N=4, 8, \text{ or } 16$; and

for DWDM, an aggregate comprises 10GE frames using Wide Interface sublayer – SONET (Synchronous Optical Network) transmission, or comprises GE and FE frames using an STM-16/OC-48 channel, wherein, for DWDM, N is at most 1024.

9. (Canceled)

10. (Previously Presented) The data transmission apparatus according to claim 1, wherein aggregate pipes in the multiple service ring comprise link and broadcast topologies.

11. (Currently Amended) A data transmission method used in a multiple service ring that comprises at least two nodes ~~electrically connected~~ transmissively coupled to at least one aggregate pipe and to at least one tributary, said method comprising:

(A) for data frames from a tributary:

receiving the data frames from the tributary;
deframing data frames received from said tributary;
extracting destination node addresses from received data frames;
encapsulating extracted destination node addresses and data
received from the tributary into data frames for the multiple service ring;
and
transmitting the data frames for the multiple service ring along an
aggregate pipe to a downstream neighbor node in the multiple service
ring; and

(B) for data frames from a neighbor node that is upstream along an aggregate pipe in the multiple service ring:

receiving data frames from the upstream neighbor node;
deframing received data frames to obtain at least destination node
addresses and data;
determining data frames for a local node based on at least one
obtained destination node address;

forwarding other data frames that are not for the local node to another node of the multiple service ring;
encapsulating data frames for the local node into tributary data frames; and
sending the tributary data frames to a corresponding tributary;
wherein at least one aggregate pipe in the multiple service ring has an N-ring structure comprised of N-M unidirectional ringlets and M unidirectional counter-rotating ringlets, where N and M are integers and $1 \leq M < N$; and
wherein the method further comprises controlling use of ringlets in the at least one aggregate pipe, wherein controlling use of ringlets comprises assigning an (n-1)-th ringlet to transport data packets in a unidirectional direction and an n-th ringlet to transport control packets in a direction opposite to the unidirectional direction, where $1 < n \leq N$.

12 and 13. (Canceled)

14. (Previously Presented) The data transmission method according to claim 11, wherein said n-th ringlet comprises a protection channel ~~of~~ for the (n-1)th ringlet in case of failure of, or signal degradation of, the (n-1)th ringlet.

15. (Previously Presented) The data transmission method according to claim 11, wherein, for data frames from the a neighbor node that is upstream, said method further comprises:

setting-up an identifier for use in identifying an originating tributary, wherein the identifier is encapsulated with a destination node address and data received from the tributary in at least one data frame of the multiple service ring.

16. (Previously Presented) The data transmission method according to claim 15, further comprising determining a tributary type and tributary number from at least one of the data frames for a local node for use in sending tributary data frames to a corresponding tributary.

17. (Previously Presented) The data transmission method according to claim 16, wherein data frames of the multiple service ring comprise FE/GE/10GE MAC frames.

18. (Previously Presented) The data transmission method according to claim 17, wherein multiple aggregates are transmitted using CWDM/DWDM (Coarse Wavelength Division Multiplex/ Dense Wavelength Division Multiplex), wherein:

for CWDM, an aggregate comprises FE, GE, and 10GE frames, where $N=4, 8$ or 16 ; and

for DWDM, an aggregate comprises 10GE frames using Wide Interface sublayer-SONET (Synchronous Optical Network) transmission, or comprises GE and FR frames using an STM-16/OC-48 channel, wherein, for DWDM, N is at most 1024.

19. (Canceled)

20. (Previously Presented) The data transmission method according to claim 11,
wherein aggregate pipes in the multiple service ring comprise link and broadcast topologies.

21. (Previously Presented) The data transmission apparatus according to claim 1,
wherein one of the N ringlets comprises a protection channel for at least one other of the N
ringlets.

22. (Previously Presented) The data transmission method according to claim 11 ,
wherein one of the N ringlets comprises a protection channel for at least one other of the N
ringlets.